

## CLAIMS

1. A green product for use in fabricating a ceramic article, comprising a ceramic powder immobilized within a silicone matrix, wherein the silicone matrix comprises one or more cross linked or polymerized silicone monomers and/or oligomers, wherein the one or more cross linked or polymerized silicone monomers and/or oligomers, prior to cross linking and/or polymerization, contain an alkenyl reactive functional group and a hydride reactive functional group.

2. The green product according to Claim 1, wherein the hydride reactive functional groups and the alkenyl reactive functional groups are present at a molar ratio of 0.5 to 3.

3. The green product according to Claim 1, wherein the one or more cross linked or polymerized silicone monomers and/or oligomers, prior to cross linking and/or polymerization, contain at least three alkenyl reactive functional groups and at least three hydride reactive functional groups per mole of monomer or oligomer.

4. The green product according to Claim 1, wherein the one or more cross linked or polymerized silicone monomers and/or oligomers, prior to cross linking and/or polymerization, is free of a solvent.

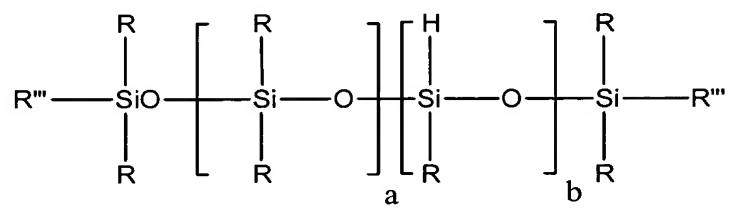
5. The green product according to Claim 1, wherein the ceramic powder comprises alumina, fused alumina, fused silica, magnesia, zirconia, spinels, mullite, glass frits, tungsten carbide, silicon carbide, boron nitride, silicon nitride, and combinations comprising at least one of the foregoing ceramics.

6. The green product according to Claim 5, wherein the ceramic powder further comprising aluminum, yttrium, hafnium, yttrium aluminate, rare earth aluminates, colloidal silica, magnesium, zirconium, or combinations comprising at least one of the foregoing.

7. The green product according to Claim 1, wherein the one or more silicone monomers and/or oligomers comprises a volume percent of about 50 to about 75 based upon the total volume of the green product.

8. The green product according to Claim 1, wherein the one or more silicone monomers and/or oligomers having the hydride functional group is selected from the group consisting of:

a polyfunctional hydride siloxane of formula:



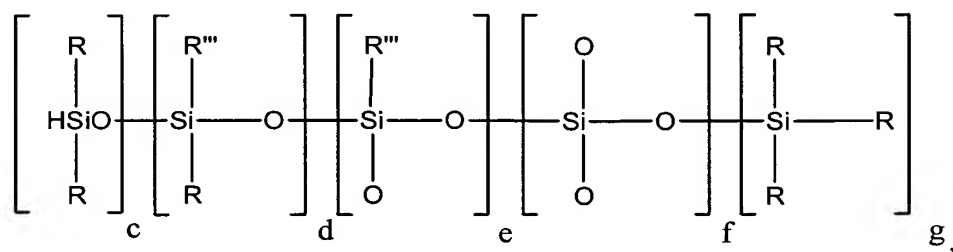
wherein R is a monovalent hydrocarbon, R''' is a monovalent hydrocarbon or hydrogen, and a and b a = 0 to 20, inclusive, and b = 1 to 80, inclusive, wherein a and b are selected to provide a fluid with maximum viscosity of 1,000 centistokes,

an alkyl/hydride cyclosiloxanes of formula:



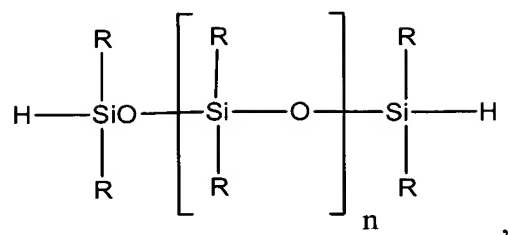
wherein x is an integer 3 to 18 inclusive,

a functional hydride siloxanes of formula:



wherein a ratio of the sum of (c+d+e+g)/f is  $\geq 2$ ,

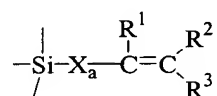
a terminal hydride siloxane of formula:



wherein  $n = 0$  to 100, and

mixtures thereof.

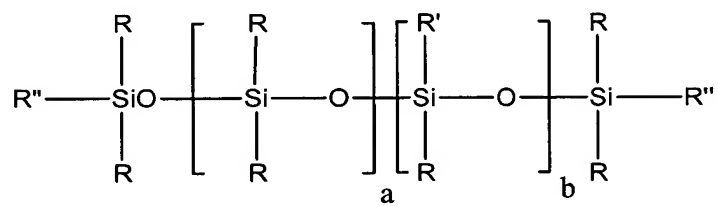
9. The green product according to Claim 1, wherein the one or more silicone monomers and/or oligomers containing the alkenyl functional group comprises a formula of:



wherein  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  each independently comprise hydrogen or a monovalent hydrocarbon radical, X a divalent hydrocarbon radical, and  $a$  is a whole number having a value between 0 and 8, inclusive.

10. The green product according to Claim 1, wherein the one or more silicone monomers and/or oligomers having the alkenyl functional group is selected from the group consisting of:

polyfunctional siloxanes of formula:



wherein R is a monovalent hydrocarbon, R' is an alkenyl radical, R'' is a monovalent hydrocarbon or an alkenyl radical,  $a = 0$  to 20, inclusive, and  $b = 1$  to 80, inclusive,

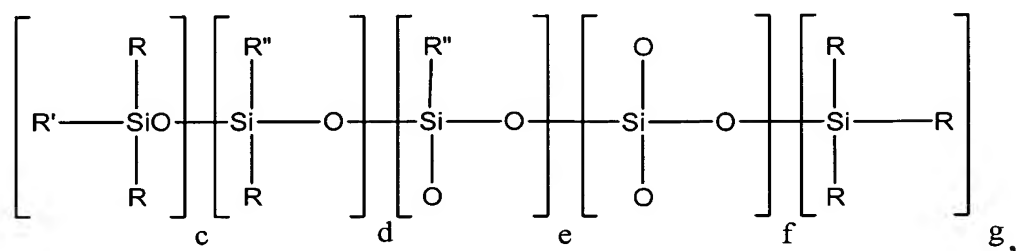
wherein  $a$  and  $b$  are selected to provide a fluid with a maximum viscosity of 1,000 centistokes,

a cyclic alkyl/alkenyl siloxane of formula:



wherein R and R' are as previously defined; wherein  $x$  is an integer 3 to 18 inclusive

an unsaturated siloxane of formula:



wherein R, R', and R'' are as previously defined. Preferably, the ratio of the sum of  $(c+d+e+g)/f$  is  $\geq 2$ ;

and mixtures thereof.

11. The green product according to Claim 1, wherein the one or more cross linked or polymerized silicone monomers and/or oligomers, prior to cross linking and/or polymerization, have a viscosity of about 1 to about 1,000 centistokes.

12. The green product according to Claim 1, wherein the silicone matrix has a crosslink density as defined by the average molecular mass of the shortest formula repeat unit distance between a reactive hydride or an alkenyl functional crosslink sites of about 30 to about 4,100 grams per mole.

13. The green product according to Claim 1, wherein the one or more cross linked or polymerized silicone monomers and/or oligomers have, prior to polymerization, at least three alkenyl reactive functional groups and at least three hydride reactive functional groups per mole of the silicone monomers and/or oligomers.

14. The green product according to Claim 1, wherein the one or more silicone monomers and/or oligomers having the hydride functional group is selected from the group consisting of poly(methylhydrogen)siloxane, poly[(methylhydrogen)-co-(dimethyl)]siloxane; 1,3,5,7-tetramethylcyclotetrasiloxane, 1,3,5,7,9-decamethylcyclopentasiloxane, cyclic methylhydrogen siloxanes; tetrakis(dimethylsiloxy)silane, hydridodimethylsiloxy silicate  $[\text{HSi}(\text{CH}_3)_2\text{O}_{1/2}]_2$  ( $\text{SiO}_2$ ), and mixtures thereof.

15. The green product according to Claim 1, wherein the one or more silicone monomers and/or oligomers having the alkenyl functional group is selected from the group consisting of 1,3-divinyl-tetramethyldisiloxane, hexavinylidisiloxane, 1,3-divinyltetraphenyldisiloxane, 1,1,3-trivinyltrimethyldisiloxane, 1,3-tetravinyl dimethyldisiloxane, 1,3,5-trivinyl-1,3,5-trimethylcyclotrisiloxane, 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane, 1,3-divinyloctaphenylcyclopentasiloxane, and mixtures thereof.

16. An investment mold fabricated with the green product of Claim 1.

17. An investment casting core fabricated with the green product of Claim 1.

18. A process for forming a green product, comprising:

mixing a ceramic powder with silicone monomers and/or oligomers to form a ceramic slurry, wherein the silicone monomers and/or oligomers contain an alkenyl

functionality of formula: 
$$\begin{array}{c} \text{R}^1 \\ | \\ -\text{Si}-\text{X}_a-\text{C}=\text{C}- \\ / \quad \quad \quad | \quad \quad \quad \backslash \\ \quad \quad \quad \text{R}^2 \quad \quad \quad \text{R}^3 \end{array}$$
, wherein  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  each independently comprise hydrogen or a monovalent hydrocarbon radical, X a divalent hydrocarbon radical and  $a$  is a whole number having a value between 0 and 8, inclusive, and a hydride functionality consisting of silicon-hydrogen bonds;

adding a metallic catalyst compound to the ceramic slurry; and

cross linking and/or polymerizing the silicone monomers and/or oligomers to form a rigid silicone matrix.

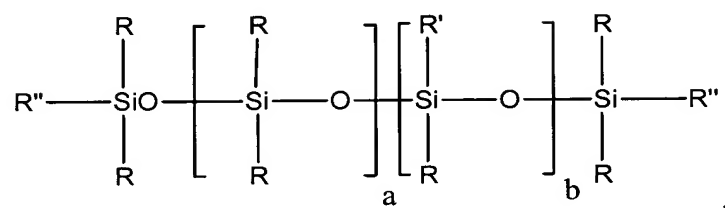
19. The process according to Claim 18, wherein mixing the ceramic powder with the silicone monomers and/or oligomers is free of a solvent.

20. The process according to Claim 18, wherein mixing the ceramic powder with the silicone monomers and/or oligomers first comprises mixing the ceramic powder with a dispersant.

21. The process according to Claim 18, wherein cross linking and/or polymerizing the silicone monomers and/or oligomers to form the rigid silicone matrix comprises heating the ceramic slurry to an elevated temperature.

22. The process according to Claim 18, wherein the one or more silicone monomers and/or oligomers containing the alkenyl functional group is selected from the group consisting of:

polyfunctional siloxanes of formula:



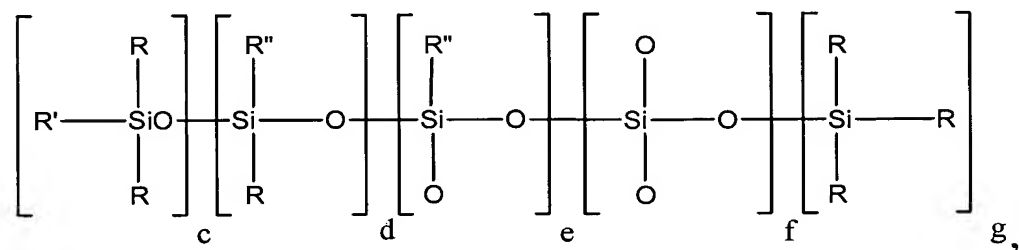
wherein R is a monovalent hydrocarbon, R' is an alkenyl radical, R'' is a monovalent hydrocarbon or an alkenyl radical,  $a = 0$  to 20, inclusive, and  $b = 1$  to 80, inclusive, wherein  $a$  and  $b$  are selected to provide a fluid with a maximum viscosity of 1,000 centistokes.

a cyclic alkyl/alkenyl siloxane of formula:



wherein R and R' are as previously defined, and x is an integer 3 to 18 inclusive;

an unsaturated siloxane of formula:

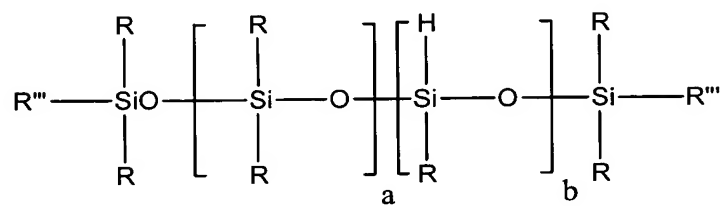


wherein R, R', and R'' are as previously defined. Preferably, the ratio of the sum of (c+d+e+g)/f is  $\geq 2$ ;

and mixtures thereof.

23. The process according to Claim 18, wherein the one or more silicone monomers and/or oligomers containing the hydride functional group is selected from the group consisting of:

a polyfunctional hydride siloxane of formula:



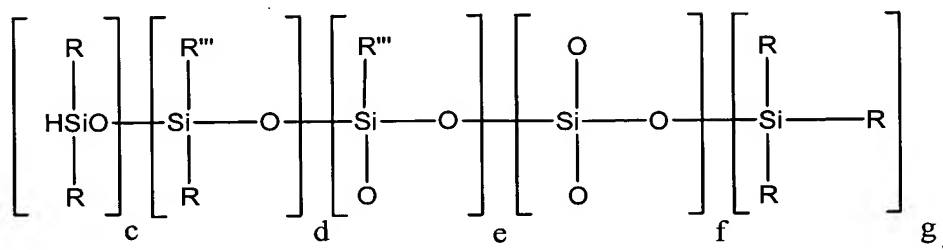
wherein R is a monovalent hydrocarbon, R''' is a monovalent hydrocarbon or hydrogen, and a and b a = 0 to 20, inclusive, and b = 1 to 80, inclusive, wherein a and b are selected to provide a fluid with maximum viscosity of 1,000 centistokes,

an alkyl/hydride cyclosiloxanes of formula:



wherein x is an integer 3 to 18 inclusive,

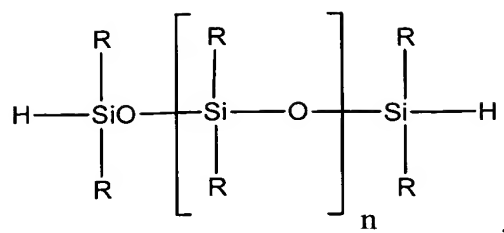
a functional hydride siloxanes of formula:



wherein a ratio of the sum of (c+d+e+g)/f is  $\geq 2$ ,

a terminal hydride siloxane of formula:





wherein  $n = 0$  to 100, and

mixtures thereof.

24. The process according to Claim 18, wherein the metallic compound comprises a platinum group metal catalyst.

25. The process according to Claim 18, further comprising heating the rigid silicone matrix to form a ceramic core having a silica char contained therein.

26. The process according to Claim 18, wherein the one or more silicone monomers and/or oligomers containing the alkenyl functional group is selected from the group consisting of 1,3-divinyl-tetramethyldisiloxane, hexavinyldisiloxane, 1,3-divinylditraphenyldisiloxane, 1,1,3-trivinyltrimethyldisiloxane, 1,3-tetravinyldimethyldisiloxane, 1,3,5-trivinyl-1,3,5-trimethylcyclotrisiloxane, 1,3,5,7-tetravinyl-1,3,5,7-tetramethylcyclotetrasiloxane, 1,3-divinyloctaphenylcyclopentasiloxane, and mixtures thereof.

27. The process according to Claim 18, wherein the one or more silicone monomers and/or oligomers containing the hydride functional group is selected from the group consisting of poly(methylhydrogen)siloxane, poly[(methylhydrogen)-co-(dimethyl)]siloxane; 1,3,5,7-tetramethylcyclotetrasiloxane, 1,3,5,7,9-decamethylcyclopentasiloxane, cyclic methylhydrogen siloxanes; tetrakis(dimethylsiloxy)silane, hydridodimethylsiloxy silicate  $[\text{HSi}(\text{CH}_3)_2\text{O}_{1/2}]_2$  ( $\text{SiO}_2$ ), and mixtures thereof.

28. A process for forming a ceramic core, comprising:

mixing a ceramic powder with silicone monomers and/or oligomers to form a ceramic slurry, wherein the silicone monomers and/or oligomers containing an

alkenyl functionality of formula: 
$$\begin{array}{c} \text{R}^1 \\ | \\ -\text{Si}-\text{X}_a-\text{C}=\text{C} \\ / \quad \quad \quad | \quad \quad \quad \backslash \\ \quad \quad \quad \text{R}^2 \quad \quad \quad \text{R}^3 \end{array}$$
, wherein  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  each independently comprise hydrogen or a monovalent hydrocarbon radical, X is a divalent hydrocarbon radical and  $a$  is a whole number having a value between 0 and 8, inclusive, and a hydride functionality consisting of silicon-hydrogen bonds;

adding a metallic catalyst to the ceramic slurry;

transferring the ceramic slurry into a mold;

cross linking and/or polymerizing the silicone monomers and/or oligomers to form a green product; and

heating the green product to a temperature effective to decompose the crosslinked and/or polymerized silicone monomers and/or oligomers and form a silica char in the ceramic core.

29. The process according to Claim 28, further comprising sintering the green product.

30. The process according to Claim 28, wherein the ceramic slurry further comprises a solvent and the process further comprises drying the green product to remove the solvent and form a plurality of pores within the green product.

31. The process according to Claim 28, wherein the hydride reactive functional group and the alkenyl reactive functional groups are present at a molar ratio of 0.5 to 3.

32. The process according to Claim 28, wherein the ceramic slurry is free of a solvent.

33. The process according to Claim 28, wherein the silicone monomers and/or oligomers containing the alkenyl functionality and the hydride functionality have at least three alkenyl functionalities and at least three hydride functionalities per monomer or oligomer repeat unit.